## Design Requirements

* Primary Source: 48V DC
* Secondary Source: 12V DC
* PWM Dimming at speeds > 10 kHz
* Switching frequency of 500 kHz
* 95% Efficiency

## Buck Converter Design (LM3409HV)

**External parallel FET shunt dimming**

fSW = 500000 # Hz Switching frequency (at nominal VIN, VO)

VIN = 48 # V Nominal input voltage:

VIN\_MAX = 75 # V Maximum input voltage

VO = 36 # V Nominal output voltage (number of LEDs x forward voltage)

rD = 0.02 # Ohm LED string dynamic resistance

ILED = 1 # A Average LED current

ΔiLED\_PP = ΔiL\_PP = 1 # A LED current ripple, Inductor current ripple

ΔvIN\_PP = 2.0 # V Input voltage ripple

VTURN\_ON = 34 # V UVLO characteristics

VHYS = 2.0 # V UVLO characteristics

η = 0.95 # Expected efficiency

**ROFF1 = 24.3e3**

ROFF = 24.51500507367445 kΩ, use 1% tol

**Closest 1% ROFF1 = 24.3 kΩ**

tOFF = 417.35985436754584 ns

fSW = 504.42397270935083 kHz

Inductor Ripple Current

L = 15.024954757231649 μH

**Closest standard value is 15.0 μH**

actual ΔiL-PP is 1.00166365048211 A

Average LED Current

IL\_MAX 1.5008318252410549 A

RSNS 0.1652416985228626 Ω

**Closest 1% RSNS1 = 0.165 Ω**

actual ILED is 1.002198477789248 A

tON = 1565.0994538782982 ns

CIN ≥ 1.5685402902656138 μF

IIN\_RMS = 408.5787383233875 mA

PFET

IT = 791.209324570459 mA

IT\_RMS = 1043.0784380578393 mA

PT = 53.312618769117904 mW

Diode

ID = 210.98915321878906 mA

PD = 179.3407802359707 mW

Dimming FET

ROFF2 = 23751.863687882003 kΩ

**Closest 1% ROFF2 = 23.7 kΩ**

UVLO

RUV2 = 90.9090909090909 kΩ

**Closest 1% RUV2 = 91.0 kΩ**

So VHYS = 2.002 V

RUV1 = 3.4444444444444446 kΩ

**Closest 1% RUV1 = 3.48 kΩ**

So VTURN\_ON = 33.66528735632184 V

## Electrical Specifications

Min Typ Max

Input Voltage (V) 34 48 75

Nominal LED Voltage (V) 36

FET Power Dissipation (mW) 53.3

Diode Power Dissipation (mW) 179.3

LED Current (mA) 1002.2

Shunt FET Pulse Duration (ns) 17

## Parts List

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Index | Quantity | Part Number | Description | Available Quantity | Unit Price USD | Extended Price USD |
| 1 | 3 | 1214-1267-ND | LED COB WHT 5600K 95CRI | 3 | 13.85 | 41.55 |
| 2 | 3 | DMPH6050SK3-13DICT-ND | MOSFET P-CH 60V 7.2A DPAK | 3 | 0.74 | 2.22 |
| 3 | 3 | SRR1260-150MCT-ND | FIXED IND 15UH 5A 27 MOHM SMD | 3 | 1.06 | 3.18 |
| 4 | 6 | P17627CT-ND | RES 0.33 OHM 1% 1/2W 1206 | 6 | 0.42 | 2.52 |
| 5 | 3 | S310FACT-ND | DIODE SCHOTTKY 100V 3A SOD123FA | 3 | 0.42 | 1.26 |
| 6 | 3 | 839-1291-ND | CONN PWR JACK 2.1X5.5MM SOLDER | 3 | 2.04 | 6.12 |
| 7 | 3 | LM3409HVMY/NOPBCT-ND | IC LED DRIVER CTRLR DIM 10MSOP | 3 | 2.16 | 6.48 |
| 8 | 3 | P91.0KCCT-ND | RES SMD 91K OHM 1% 1/8W 0805 | 3 | 0.1 | 0.3 |
| 9 | 3 | P24.3KCCT-ND | RES SMD 24.3K OHM 1% 1/8W 0805 | 3 | 0.1 | 0.3 |
| 10 | 3 | 490-6369-1-ND | CAP CER 470PF 100V X7R 0402 | 3 | 0.1 | 0.3 |
| 11 | 3 | 296-44612-1-ND | MOSFET NCH 100V 13.1A 6WSON | 3 | 0.9 | 2.7 |
| 12 | 3 | 296-30285-1-ND | IC GATE DVR LOW SIDE 1CH SOT23-6 | 3 | 1.46 | 4.38 |
| 13 | 3 | 541-23.7KCCT-ND | RES SMD 23.7K OHM 1% 1/8W 0805 | 3 | 0.1 | 0.3 |
| 14 | 6 | B0530WS RRGCT-ND | DIODE SCHOTTKY 30V 200MA SOD323F | 6 | 0.24 | 1.44 |
| 15 | 10 | 311-1.0GRCT-ND | RES SMD 1 OHM 5% 1/10W 0603 | 10 | 0.011 | 0.11 |
| 16 | 3 | 399-1170-1-ND | CAP CER 0.1UF 50V X7R 0805 | 3 | 0.1 | 0.3 |
| 17 | 6 | 1276-2928-1-ND | CAP CER 1UF 50V X7R 0805 | 6 | 0.11 | 0.66 |
| 18 | 10 | 311-10.0KHRCT-ND | RES SMD 10K OHM 1% 1/10W 0603 | 10 | 0.015 | 0.15 |
| 19 | 10 | 311-3.48KCRCT-ND | RES SMD 3.48K OHM 1% 1/8W 0805 | 10 | 0.022 | 0.22 |
| 20 | 3 | 1276-3362-1-ND | CAP CER 2.2UF 100V X7R 1210 | 3 | 0.51 | 1.53 |